

1  
SEQUENCE LISTING

<110> Trustees of Dartmouth College et al.

<120> NOVEL MOLECULES OF THE MULTI-DRUG AND TOXIN  
EFFLUX (MATE) PROTEIN FAMILY AND USES THEREOF

<130> DCI-111PC

<150> 60/280, 621

<151> 2001-03-30

<160> 20

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<211> 5738

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5738

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&lt;212&gt; DNA

<213> *Arabidopsis thaliana*

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&lt;210&gt; 5

&lt;211&gt; 1867

&lt;212&gt; DNA

&lt;213&gt; Arabidopsis thaliana

&lt;220&gt;

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&lt;222&gt; (118)...(1182)

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&lt;210&gt; 6

&lt;211&gt; 355

&lt;212&gt; PRT

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tcaacagcta	tgatcttggg	gttaatcctt	ggccttgtgc	aagctatttt	cttgattttc	3540
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ctcctctctt	tgccactgat	aattaagttg	tttaacttaga	tcatctttta	tgatcactct	3840
ccttacttct	tataatatatt	tgccttaatg	cgtgaaacag	tcgtagcaga	tgttatcaac	3900
atagttctcg	accccatctt	cattttttgtg	cttcgtctag	ggatcatcgg	tcgagccatt	3960

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gcccatgtca tttctcagta agagaaatca ctaaaaaaat tccacacatg caaaagtgat 4020
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gaagtcataa cctcaaacaa aaacaaatga tttgtttgtg tacgtgaagg tacttcatga 4140
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&lt;210&gt; 8

&lt;211&gt; 1950

&lt;212&gt; DNA

<213> *Arabidopsis thaliana*

&lt;220&gt;

&lt;221&gt; CDS

&lt;222&gt; (118)...(870)

&lt;400&gt; 8

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aaataatccc ctctaaactc tcctagatac tcaactcatca ctactcatct caagttcacg 60
tgactactta tataagcggt gactacataa agagacagtt acagaggaaa aagatct atg 120
Met
1

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acg gaa act ggt gat gat ctt gct acg gtg aag aag cca atc cca ttt 168
Thr Glu Thr Gly Asp Asp Leu Ala Thr Val Lys Lys Pro Ile Pro Phe
5 10 15

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ctc gtt atc ttc aaa gat tta aga cat gta ttc agt agg gac aca act 216
Leu Val Ile Phe Lys Asp Leu Arg His Val Phe Ser Arg Asp Thr Thr
20 25 30

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ggg cga gag att cta ggc atc gcg ttt cca gca gct ttg gct tta gct 264
Gly Arg Glu Ile Leu Gly Ile Ala Phe Pro Ala Ala Leu Ala Leu Ala
35 40 45

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14

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gct gat cca atc gct tct ctg att gat acc gct ttt gtc ggg cgt tta 312
Ala Asp Pro Ile Ala Ser Leu Ile Asp Thr Ala Phe Val Gly Arg Leu
50 55 60 65

gga gcg gtt cag cta gcg gcg gtt gga gtt tcc att gcc ata ttc aat 360
Gly Ala Val Gln Leu Ala Ala Val Gly Val Ser Ile Ala Ile Phe Asn
70 75 80

caa gct tct aga att acg ata ttc cca ctt gtg agc ctc aca act tca 408
Gln Ala Ser Arg Ile Thr Ile Phe Pro Leu Val Ser Leu Thr Thr Ser
85 90 95

ttt gtg gca gag gaa gac acg atg gag aag atg aaa gaa gaa gca aac 456
Phe Val Ala Glu Glu Asp Thr Met Glu Lys Met Lys Glu Glu Ala Asn
100 105 110

aaa gcc aat ctt gtt cat gca gaa act ata ctt gtt caa gat tct ttg 504
Lys Ala Asn Leu Val His Ala Glu Thr Ile Leu Val Gln Asp Ser Leu
115 120 125

gaa aag ggc att tct tca cct aca agt aac gat acc aac cag cca cag 552
Glu Lys Gly Ile Ser Ser Pro Thr Ser Asn Asp Thr Asn Gln Pro Gln
130 135 140 145

caa cct cca gct ccg gat aca aag tca aat agc gga aac aaa tcg aat 600
Gln Pro Pro Ala Pro Asp Thr Lys Ser Asn Ser Gly Asn Lys Ser Asn
150 155 160

aaa aag gag aag agg acc att aga aca gca tca aca gct atg atc ttg 648
Lys Lys Glu Lys Arg Thr Ile Arg Thr Ala Ser Thr Ala Met Ile Leu
165 170 175

ggg tta atc ctt ggc ctt gtg caa gct att ttc ttg att ttc agt tca 696
Gly Leu Ile Leu Gly Leu Val Gln Ala Ile Phe Leu Ile Phe Ser Ser
180 185 190

aag ttg ctt cta ggc gtc atg gga gtg aaa cca aat tca cca atg tta 744
Lys Leu Leu Leu Gly Val Met Gly Val Lys Pro Asn Ser Pro Met Leu
195 200 205

tca cca gca cac aag tac ttg agc ata cga gct ttg ggg gct cct gca 792
Ser Pro Ala His Lys Tyr Leu Ser Ile Arg Ala Leu Gly Ala Pro Ala
210 215 220 225

ttg ctt cta tct ctt gct atg caa ggc atc ttt cgt gga ttc aag gac 840
Leu Leu Leu Ser Leu Ala Met Gln Gly Ile Phe Arg Gly Phe Lys Asp
230 235 240

acc aaa act cct ctc ttt gcc act gat aat taagttggta acttagatca 890
Thr Lys Thr Pro Leu Phe Ala Thr Asp Asn
245 250

tctttaatga tcaactctcct tacttcttat aatattttgc cttaatgcgt gaaacagtcg 950
tagcagatgt tatcaacata gttctcgacc ccatcttcat ttttgtgctt cgtctaggga 1010
tcatcggtgc agccattgcc catgtcattt ctccagtactt catgactcta atattgttcg 1070
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ggttccttaa aaatgggcta ctattgctgg cgaggaccat agcagtgacg ttttgtcaga 1190
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15

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gtttacaagt atgggttaact tcttctcttc tcaatgatgg tcttgccggt gctgggtcagg 1310
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&lt;210&gt; 9

&lt;211&gt; 251

&lt;212&gt; PRT

&lt;213&gt; Arabidopsis thaliana

&lt;400&gt; 9

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Met Thr Glu Thr Gly Asp Asp Leu Ala Thr Val Lys Lys Pro Ile Pro
 1          5          10          15
Phe Leu Val Ile Phe Lys Asp Leu Arg His Val Phe Ser Arg Asp Thr
 20          25          30
Thr Gly Arg Glu Ile Leu Gly Ile Ala Phe Pro Ala Ala Leu Ala Leu
 35          40          45
Ala Ala Asp Pro Ile Ala Ser Leu Ile Asp Thr Ala Phe Val Gly Arg
 50          55          60
Leu Gly Ala Val Gln Leu Ala Ala Val Gly Val Ser Ile Ala Ile Phe
 65          70          75          80
Asn Gln Ala Ser Arg Ile Thr Ile Phe Pro Leu Val Ser Leu Thr Thr
 85          90          95
Ser Phe Val Ala Glu Glu Asp Thr Met Glu Lys Met Lys Glu Glu Ala
100          105          110
Asn Lys Ala Asn Leu Val His Ala Glu Thr Ile Leu Val Gln Asp Ser
115          120          125
Leu Glu Lys Gly Ile Ser Ser Pro Thr Ser Asn Asp Thr Asn Gln Pro
130          135          140

Gln Gln Pro Pro Ala Pro Asp Thr Lys Ser Asn Ser Gly Asn Lys Ser
145          150          155          160
Asn Lys Lys Glu Lys Arg Thr Ile Arg Thr Ala Ser Thr Ala Met Ile
165          170          175
Leu Gly Leu Ile Leu Gly Leu Val Gln Ala Ile Phe Leu Ile Phe Ser
180          185          190
Ser Lys Leu Leu Leu Gly Val Met Gly Val Lys Pro Asn Ser Pro Met
195          200          205
Leu Ser Pro Ala His Lys Tyr Leu Ser Ile Arg Ala Leu Gly Ala Pro
210          215          220
Ala Leu Leu Leu Ser Leu Ala Met Gln Gly Ile Phe Arg Gly Phe Lys
225          230          235          240
Asp Thr Lys Thr Pro Leu Phe Ala Thr Asp Asn
245          250

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&lt;210&gt; 10

&lt;211&gt; 523

&lt;212&gt; PRT

&lt;213&gt; Arabidopsis thaliana

&lt;400&gt; 10

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Met Thr Glu Thr Gly Asp Asp Leu Ala Thr Val Lys Lys Pro Ile Pro
 1      5      10      15
Phe Leu Val Ile Phe Lys Asp Leu Arg His Val Phe Ser Arg Asp Thr
      20      25      30
Thr Gly Arg Glu Ile Leu Gly Ile Ala Phe Pro Ala Ala Leu Ala Leu
      35      40      45
Ala Ala Asp Pro Ile Ala Ser Leu Ile Asp Thr Ala Phe Val Gly Arg
      50      55      60
Leu Gly Ala Val Gln Leu Ala Ala Val Gly Val Ser Ile Ala Ile Phe
65      70      75      80
Asn Gln Ala Ser Arg Ile Thr Ile Phe Pro Leu Val Ser Leu Thr Thr
      85      90      95
Ser Phe Val Ala Glu Glu Asp Thr Met Glu Lys Met Lys Glu Glu Ala
      100     105     110
Asn Lys Ala Asn Leu Val His Ala Glu Thr Ile Leu Val Gln Asp Ser
      115     120     125
Leu Glu Lys Gly Ile Ser Ser Pro Thr Ser Asn Asp Thr Asn Gln Pro
      130     135     140
Gln Gln Pro Pro Ala Pro Asp Thr Lys Ser Asn Ser Gly Asn Lys Ser
145      150     155     160
Asn Lys Lys Glu Lys Arg Thr Ile Arg Thr Ala Ser Thr Ala Met Ile
      165     170     175
Leu Gly Leu Ile Leu Gly Leu Val Gln Ala Ile Phe Leu Ile Phe Ser
      180     185     190
Ser Lys Leu Leu Leu Gly Val Met Gly Val Lys Pro Asn Ser Pro Met
      195     200     205
Leu Ser Pro Ala His Lys Tyr Leu Ser Ile Arg Ala Leu Gly Ala Pro
      210     215     220
Ala Leu Leu Leu Ser Leu Ala Met Gln Gly Ile Phe Arg Gly Phe Lys
225      230     235     240
Asp Thr Lys Thr Pro Leu Phe Ala Thr Val Val Ala Asp Val Ile Asn
      245     250     255
Ile Val Leu Asp Pro Ile Phe Ile Phe Val Leu Arg Leu Gly Ile Ile
      260     265     270
Gly Ala Ala Ile Ala His Val Ile Ser Gln Tyr Phe Met Thr Leu Ile
      275     280     285
Leu Phe Val Phe Leu Ala Lys Lys Val Asn Leu Ile Pro Pro Asn Phe
      290     295     300

Gly Asp Leu Gln Phe Gly Arg Phe Leu Lys Asn Gly Leu Leu Leu Leu
305      310     315     320
Ala Arg Thr Ile Ala Val Thr Phe Cys Gln Thr Leu Ala Ala Ala Met
      325     330     335
Ala Ala Arg Leu Gly Thr Thr Pro Met Ala Ala Phe Gln Ile Cys Leu
      340     345     350
Gln Val Trp Leu Thr Ser Ser Leu Leu Asn Asp Gly Leu Ala Val Ala
      355     360     365
Gly Gln Ala Leu Ala Cys Ser Phe Ala Glu Lys Asp Tyr Asn Lys Val
      370     375     380
Thr Ala Val Ala Ser Arg Val Leu Gln Met Gly Phe Val Leu Gly Leu
385      390     395     400
Gly Leu Ser Val Phe Val Gly Leu Gly Leu Tyr Phe Gly Ala Gly Val
      405     410     415
Phe Ser Lys Asp Pro Ala Val Ile His Leu Met Ala Ile Gly Ile Pro
      420     425     430
Phe Ala Ala Thr Gln Pro Ile Asn Ser Leu Ala Phe Val Leu Asp Gly
      435     440     445

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17

Val Asn Phe Gly Ala Ser Asp Phe Ala Tyr Thr Ala Tyr Ser Met Val  
 450 455 460  
 Gly Val Ala Ala Ile Ser Ala Ala Val Ile Tyr Met Ala Lys Thr Asn  
 465 470 475 480  
 Gly Phe Ile Gly Ile Trp Ile Ala Leu Thr Ile Tyr Met Ala Leu Arg  
 485 490 495  
 Ala Ile Thr Gly Ile Ala Arg Met Ala Thr Gly Thr Gly Pro Trp Arg  
 500 505 510  
 Phe Leu Arg Gly Arg Ser Ser Ser Ser Ser Ser  
 515 520

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 <211> 16  
 <212> PRT  
 <213> Arabidopsis thaliana

<400> 11  
 Pro Ala Asn Asp Val Thr Leu Pro Ile Lys Glu Asp Asp Ser Ser Asn  
 1 5 10 15

<210> 12  
 <211> 501  
 <212> PRT  
 <213> Arabidopsis thaliana

<400> 12  
 Met Ser Glu Asp Gly Tyr Asn Thr Asp Phe Pro Arg Asn Pro Leu Tyr  
 1 5 10 15  
 Ile Phe Phe Ser Asp Phe Arg Ser Val Leu Lys Phe Asp Glu Leu Gly  
 20 25 30  
 Leu Glu Ile Ala Arg Ile Ala Leu Pro Ala Ala Leu Ala Thr Ala  
 35 40 45  
 Asp Pro Ile Ala Ser Leu Val Asp Thr Ala Phe Ile Gly Gln Ile Gly  
 50 55 60  
 Pro Val Glu Leu Ala Ala Val Gly Val Ser Ile Ala Leu Phe Asn Gln  
 65 70 75 80  
 Val Ser Arg Ile Ala Ile Phe Pro Leu Val Ser Ile Thr Thr Ser Phe  
 85 90 95  
 Val Ala Glu Glu Asp Ala Cys Ser Ser Gln Gln Asp Thr Val Arg Asp  
 100 105 110  
 His Lys Glu Cys Ile Glu Ile Gly Ile Asn Asn Pro Thr Glu Glu Thr  
 115 120 125  
 Ile Glu Leu Ile Pro Glu Lys His Lys Asp Ser Leu Ser Asp Glu Phe  
 130 135 140  
 Lys Thr Ser Ser Ser Ile Phe Ser Ile Ser Lys Pro Pro Ala Lys Lys  
 145 150 155 160  
 Arg Asn Ile Pro Ser Ala Ser Ser Ala Leu Ile Ile Gly Gly Val Leu  
 165 170 175  
 Gly Leu Phe Gln Ala Val Phe Leu Ile Ser Ala Ala Lys Pro Leu Leu  
 180 185 190  
 Ser Phe Met Gly Val Lys His Asp Ser Pro Met Met Arg Pro Ser Gln  
 195 200 205  
 Arg Tyr Leu Ser Leu Arg Ser Leu Gly Ala Pro Ala Val Leu Leu Ser  
 210 215 220  
 Leu Ala Ala Gln Gly Val Phe Arg Gly Phe Lys Asp Thr Thr Thr Pro  
 225 230 235 240  
 Leu Phe Ala Thr Val Ile Gly Asp Val Thr Asn Ile Ile Leu Asp Pro  
 245 250 255

18

Ile Phe Ile Phe Val Phe Arg Leu Gly Val Thr Gly Ala Ala Thr Ala  
 260 265 270  
 His Val Ile Ser Gln Tyr Leu Met Cys Gly Ile Leu Leu Trp Lys Leu  
 275 280 285  
 Met Gly Gln Val Asp Ile Phe Asn Met Ser Thr Lys His Leu Gln Phe  
 290 295 300  
 Cys Arg Phe Met Lys Asn Gly Phe Leu Leu Leu Met Arg Val Ile Ala  
 305 310 315 320  
 Val Thr Phe Cys Val Thr Leu Ser Ala Ser Leu Ala Ala Arg Glu Gly  
 325 330 335  
 Ser Thr Ser Met Ala Ala Phe Gln Val Cys Leu Gln Val Trp Leu Ala  
 340 345 350  
 Thr Ser Leu Leu Ala Asp Gly Tyr Ala Val Ala Gly Gln Ala Ile Leu  
 355 360 365  
 Ala Ser Ala Phe Ala Lys Lys Asp Tyr Lys Arg Ala Ala Thr Ala  
 370 375 380  
 Ser Arg Val Leu Gln Leu Gly Leu Val Leu Gly Phe Val Leu Ala Val  
 385 390 395 400  
 Ile Leu Gly Ala Gly Leu His Phe Gly Ala Arg Val Phe Thr Lys Asp  
 405 410 415  
 Asp Lys Val Leu His Leu Ile Ser Ile Gly Leu Pro Phe Val Ala Gly  
 420 425 430  
 Thr Gln Pro Ile Asn Ala Leu Ala Phe Val Phe Asp Gly Val Asn Phe  
 435 440 445  
 Gly Ala Ser Asp Phe Gly Tyr Ala Ala Ala Ser Leu Val Met Val Ala  
 450 455 460  
 Ile Val Ser Ile Leu Cys Leu Leu Phe Leu Ser Ser Thr His Gly Phe  
 465 470 475 480  
 Ile Gly Leu Trp Phe Gly Leu Thr Ile Tyr Met Ser Leu Arg Ala Ala  
 485 490 495  
 Val Gly Phe Trp Arg  
 500

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 <211> 479  
 <212> PRT  
 <213> Arabidopsis thaliana

<400> 13  
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 1 5 10 15  
 Ala Arg Glu Val Asn Gly Val His Thr Gly Val Ala Arg Pro Val Asp  
 20 25 30  
 Ile Lys Arg Glu Leu Val Met Leu Ser Leu Pro Ala Ile Ala Gly Gln  
 35 40 45  
 Ala Ile Asp Pro Leu Thr Leu Leu Met Glu Thr Ala Tyr Ile Gly Arg  
 50 55 60  
 Leu Gly Ser Val Glu Leu Gly Ser Ala Gly Val Ser Met Ala Ile Phe  
 65 70 75 80  
 Asn Thr Ile Ser Lys Leu Phe Asn Ile Pro Leu Leu Ser Val Ala Thr  
 85 90 95  
 Ser Phe Val Ala Glu Asp Ile Ala Lys Ile Ala Ala Gln Asp Leu Ala  
 100 105 110  
 Ser Glu Asp Ser Gln Ser Asp Ile Pro Ser Gln Gly Leu Pro Glu Arg  
 115 120 125  
 Lys Gln Leu Ser Ser Val Ser Thr Ala Leu Val Leu Ala Ile Gly Ile  
 130 135 140

19

Gly Ile Phe Glu Ala Leu Ala Leu Ser Leu Ala Ser Gly Pro Phe Leu  
 145 150 155 160  
 Arg Leu Met Gly Ile Gln Ser Val Ser Ser Val Gln Arg Met Ser Glu  
 165 170 175  
 Met Phe Ile Pro Ala Arg Gln Phe Leu Val Leu Arg Ala Leu Gly Ala  
 180 185 190  
 Pro Ala Tyr Val Val Ser Leu Ala Leu Gln Gly Ile Phe Arg Gly Phe  
 195 200 205  
 Lys Asp Thr Lys Thr Pro Val Tyr Cys Leu Val Leu Ser Phe Pro Asn  
 210 215 220  
 Phe His Asn Ser Gly Ile Gly Asn Phe Leu Ala Val Phe Leu Phe Pro  
 225 230 235 240  
 Leu Phe Ile Tyr Lys Phe Arg Met Gly Val Ala Gly Ala Ala Ile Ser  
 245 250 255  
 Ser Val Ile Ser Gln Met Val Leu Asn Pro Phe Pro Leu Ile His Arg  
 260 265 270  
 Tyr Thr Val Ala Ile Leu Met Leu Ile Leu Leu Asn Lys Arg Val Ile  
 275 280 285  
 Leu Leu Pro Pro Lys Ile Gly Ser Leu Lys Phe Gly Asp Tyr Leu Lys  
 290 295 300  
 Ser Gly Gly Phe Val Leu Gly Arg Thr Leu Ser Val Leu Val Thr Met  
 305 310 315 320  
 Thr Val Ala Thr Ser Met Ala Ala Arg Gln Gly Val Phe Ala Met Ala  
 325 330 335  
 Ala His Gln Ile Cys Met Gln Val Trp Leu Ala Val Ser Leu Leu Thr  
 340 345 350  
 Asp Ala Leu Ala Ser Ser Gly Gln Ala Leu Ile Ala Ser Ser Ala Ser  
 355 360 365  
 Lys Arg Asp Phe Glu Gly Val Lys Glu Phe Ile Phe Thr Phe Trp Gly  
 370 375 380  
 Cys Tyr Leu Ile Ser Cys Tyr Ile Tyr Ile Tyr Arg Glu Arg Cys Asn  
 385 390 395 400  
 Val Phe Gly Val Val Gln Ile Gly Val Val Thr Gly Ile Ala Leu Ala  
 405 410 415  
 Ile Val Leu Gly Met Ser Phe Ser Ser Ile Ala Asp Gly Gly Gly Arg  
 420 425 430  
 Asn Ile Ile Ser Val His Ala Val Cys Thr Gly Arg Val Gly Ala Lys  
 435 440 445  
 Trp Ser Val Gly Gly Ala Glu His Val His Gly Ile Ala Asp Gly Gly  
 450 455 460  
 Trp Ile Gln Gln Val Lys Lys Glu Leu Pro Val Ser Ile Tyr Lys  
 465 470 475

&lt;210&gt; 14

&lt;211&gt; 484

&lt;212&gt; PRT

&lt;213&gt; Arabidopsis thaliana

&lt;400&gt; 14

Met Ala Asp Pro Ala Thr Ser Ser Pro Leu Leu Asp Asp His Val Gly  
 1 5 10 15  
 Gly Glu Asp Glu Arg Gly Arg Arg Ser Arg Ser Ser Thr Leu Val Gln  
 20 25 30  
 Lys Val Ile Asp Val Glu Glu Ala Lys Ala Gln Met Ile Tyr Ser Leu  
 35 40 45  
 Pro Met Ile Leu Thr Asn Val Phe Tyr Tyr Cys Ile Pro Ile Thr Ser  
 50 55 60

Val	Met	Phe	Ala	Ser	His	Leu	Gly	Gln	Leu	Glu	Leu	Ala	Gly	Ala	Thr	65	70	75	80
Leu	Ala	Asn	Ser	Trp	Ala	Thr	Val	Ser	Gly	Phe	Ala	Phe	Met	Val	Gly	85	90		95
Leu	Ser	Gly	Ser	Leu	Glu	Thr	Leu	Cys	Gly	Gln	Gly	Phe	Gly	Ala	Lys	100	105		110
Arg	Tyr	Arg	Met	Leu	Gly	Val	His	Leu	Gln	Ser	Ser	Cys	Ile	Val	Ser	115	120		125
Leu	Val	Phe	Ser	Ile	Leu	Ile	Thr	Ile	Phe	Trp	Phe	Phe	Thr	Glu	Ser	130	135		140
Ile	Phe	Gly	Leu	Leu	Arg	Gln	Asp	Pro	Ser	Ile	Ser	Lys	Gln	Ala	Ala	145	150	155	160
Leu	Tyr	Met	Lys	Tyr	Gln	Ala	Pro	Gly	Leu	Leu	Ala	Tyr	Gly	Phe	Leu	165	170		175
Gln	Asn	Ile	Leu	Arg	Phe	Cys	Gln	Thr	Gln	Ser	Ile	Ile	Ala	Pro	Leu	180	185		190
Val	Ile	Phe	Ser	Phe	Val	Pro	Leu	Val	Ile	Asn	Ile	Ala	Thr	Ala	Tyr	195	200		205
Val	Leu	Val	Tyr	Val	Ala	Gly	Leu	Gly	Phe	Ile	Gly	Ala	Pro	Ile	Ala	210	215	220	
Thr	Ser	Ile	Ser	Leu	Trp	Ile	Ala	Phe	Leu	Ser	Leu	Gly	Thr	Tyr	Val	225	230	235	240
Met	Cys	Ser	Glu	Lys	Phe	Lys	Glu	Thr	Trp	Thr	Gly	Phe	Ser	Leu	Glu	245	250		255
Ser	Phe	Arg	Tyr	Ile	Val	Ile	Asn	Leu	Thr	Leu	Ser	Leu	Pro	Ser	Ala	260	265		270
Ala	Met	Leu	Lys	Arg	Leu	Tyr	Cys	Cys	Asn	Ser	Leu	Glu	Tyr	Trp	Ala	275	280	285	
Phe	Glu	Ile	Leu	Val	Phe	Leu	Ala	Gly	Val	Met	Pro	Asn	Pro	Glu	Ile	290	295	300	
Asn	Thr	Ser	Leu	Val	Ala	Ile	Cys	Val	Asn	Thr	Glu	Ala	Ile	Ser	Tyr	305	310	315	320
Met	Leu	Thr	Tyr	Gly	Leu	Ser	Ala	Ala	Ala	Ser	Thr	Arg	Val	Ser	Asn	325	330		335
Glu	Leu	Gly	Ala	Gly	Asn	Val	Lys	Gly	Ala	Lys	Lys	Ala	Thr	Ser	Val	340	345		350
Ser	Val	Lys	Leu	Ser	Leu	Val	Leu	Ala	Leu	Gly	Val	Val	Ile	Val	Leu	355	360	365	
Leu	Val	Gly	His	Asp	Gly	Trp	Val	Gly	Leu	Phe	Ser	Asp	Ser	Tyr	Val	370	375	380	
Ile	Lys	Glu	Glu	Phe	Ala	Ser	Leu	Arg	Phe	Phe	Leu	Ala	Ala	Ser	Ile	385	390	395	400
Thr	Leu	Asp	Ser	Ile	Gln	Gly	Val	Leu	Ser	Gly	Val	Ala	Arg	Gly	Cys	405	410		415
Gly	Trp	Gln	Arg	Leu	Val	Thr	Val	Ile	Asn	Leu	Ala	Thr	Phe	Tyr	Leu	420	425		430
Ile	Gly	Met	Pro	Ile	Ala	Ala	Phe	Cys	Gly	Phe	Lys	Leu	Lys	Phe	Tyr	435	440	445	
Ala	Lys	Gly	Leu	Trp	Ile	Gly	Leu	Ile	Cys	Gly	Ile	Phe	Cys	Gln	Ser	450	455	460	
Ser	Ser	Leu	Leu	Leu	Met	Thr	Ile	Phe	Arg	Lys	Trp	Thr	Lys	Leu	Asn	465	470	475	480
Val	Ala	Thr	Val																

<210> 15  
 <211> 507  
 <212> PRT  
 <213> Arabidopsis thaliana

<400> 15

Met	Ser	Ser	Thr	Glu	Thr	Tyr	Glu	Pro	Leu	Leu	Thr	Arg	Leu	His	Ser
1				5					10					15	
Asp	Ser	Gln	Ile	Thr	Glu	Arg	Ser	Ser	Pro	Glu	Ile	Glu	Glu	Phe	Leu
			20					25					30		
Arg	Arg	Arg	Gly	Ser	Thr	Val	Thr	Pro	Arg	Trp	Trp	Leu	Lys	Leu	Ala
		35					40					45			
Val	Trp	Glu	Ser	Lys	Leu	Leu	Trp	Thr	Leu	Ser	Gly	Ala	Ser	Ile	Val
	50					55					60				
Val	Ser	Val	Leu	Asn	Tyr	Met	Leu	Ser	Phe	Val	Thr	Val	Met	Phe	Thr
65					70					75					80
Gly	His	Leu	Gly	Ser	Leu	Gln	Leu	Ala	Gly	Ala	Ser	Ile	Ala	Thr	Val
				85					90					95	
Gly	Ile	Gln	Gly	Leu	Ala	Tyr	Gly	Ile	Met	Leu	Gly	Met	Ala	Ser	Ala
			100					105					110		
Val	Gln	Thr	Val	Cys	Gly	Gln	Ala	Tyr	Gly	Ala	Arg	Gln	Tyr	Ser	Ser
		115					120					125			
Met	Gly	Ile	Ile	Cys	Gln	Arg	Ala	Met	Val	Leu	His	Leu	Ala	Ala	Ala
	130					135					140				
Val	Phe	Leu	Thr	Phe	Leu	Tyr	Trp	Tyr	Ser	Gly	Pro	Ile	Leu	Lys	Thr
145					150					155					160
Met	Gly	Gln	Ser	Val	Ala	Ile	Ala	His	Glu	Gly	Gln	Ile	Phe	Ala	Arg
				165					170					175	
Gly	Met	Ile	Pro	Gln	Ile	Tyr	Ala	Phe	Ala	Leu	Ala	Cys	Pro	Met	Gln
			180					185					190		
Arg	Phe	Leu	Gln	Ala	Gln	Asn	Ile	Val	Asn	Pro	Leu	Ala	Tyr	Met	Ser
		195				200						205			
Leu	Gly	Val	Phe	Leu	Leu	His	Thr	Leu	Leu	Thr	Trp	Leu	Val	Thr	Asn
	210					215					220				
Val	Leu	Asp	Phe	Gly	Leu	Leu	Gly	Ala	Ala	Leu	Ile	Leu	Ser	Phe	Ser
225					230					235					240
Trp	Trp	Leu	Leu	Val	Ala	Val	Asn	Gly	Met	Tyr	Ile	Leu	Met	Ser	Pro
				245					250					255	
Asn	Cys	Lys	Glu	Thr	Trp	Thr	Gly	Phe	Ser	Thr	Arg	Ala	Phe	Arg	Gly
			260					265					270		
Ile	Trp	Pro	Tyr	Phe	Lys	Leu	Thr	Val	Ala	Ser	Ala	Val	Met	Leu	Cys
		275					280					285			
Leu	Glu	Ile	Trp	Tyr	Asn	Gln	Gly	Leu	Val	Ile	Ile	Ser	Gly	Leu	Leu
	290					295						300			
Ser	Asn	Pro	Thr	Ile	Ser	Leu	Asp	Ala	Ile	Ser	Ile	Cys	Met	Tyr	Tyr
305					310					315					320
Leu	Asn	Trp	Asp	Met	Gln	Phe	Met	Leu	Gly	Leu	Ser	Ala	Ala	Ile	Ser
				325					330					335	
Val	Arg	Val	Ser	Asn	Glu	Leu	Gly	Ala	Gly	Asn	Pro	Arg	Val	Ala	Met
			340					345					350		
Leu	Ser	Val	Val	Val	Val	Asn	Ile	Thr	Thr	Val	Leu	Ile	Ser	Ser	Val
		355					360					365			
Leu	Cys	Val	Ile	Val	Leu	Val	Phe	Arg	Val	Gly	Leu	Ser	Lys	Ala	Phe
	370					375					380				
Thr	Ser	Asp	Ala	Glu	Val	Ile	Ala	Ala	Val	Ser	Asp	Leu	Phe	Pro	Leu
385					390					395					400
Leu	Ala	Val	Ser	Ile	Phe	Leu	Asn	Gly	Ile	Gln	Pro	Ile	Leu	Ser	Gly
				405					410					415	

Val Ala Ile Gly Ser Gly Trp Gln Ala Val Val Ala Tyr Val Asn Leu  
 420 425 430  
 Val Thr Tyr Tyr Val Ile Gly Leu Pro Ile Gly Cys Val Leu Gly Phe  
 435 440 445  
 Lys Thr Ser Leu Gly Val Ala Gly Ile Trp Trp Gly Met Ile Ala Gly  
 450 455 460  
 Val Ile Leu Gln Thr Leu Thr Leu Ile Val Leu Thr Leu Lys Thr Asn  
 465 470 475 480  
 Trp Thr Ser Glu Val Glu Asn Ala Ala Gln Arg Val Lys Thr Ser Ala  
 485 490 495  
 Thr Glu Asn Gln Glu Met Ala Asn Ala Gly Val  
 500 505

<210> 16  
 <211> 536  
 <212> PRT  
 <213> Arabidopsis thaliana

<400> 16  
 Thr Leu Gln Gln Glu Ala Trp Gln Gln Gly Tyr Asp Ser His Asp Arg  
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 Lys Arg Leu Leu Asp Glu Glu Arg Asp Leu Leu Ile Asp Asn Lys Leu  
 20 25 30  
 Leu Ser Gln His Gly Asn Gly Gly Gly Asp Ile Glu Ser His Gly His  
 35 40 45  
 Gly Gln Ala Ile Gly Pro Asp Glu Glu Glu Arg Pro Ala Glu Ile Ala  
 50 55 60  
 Asn Thr Trp Glu Ser Ala Ile Glu Ser Gly Gln Lys Ile Ser Thr Thr  
 65 70 75 80  
 Phe Lys Arg Glu Thr Gln Val Ile Thr Met Asn Ala Leu Pro Leu Ile  
 85 90 95  
 Phe Thr Phe Ile Leu Gln Asn Ser Leu Ser Leu Ala Ser Ile Phe Ser  
 100 105 110  
 Val Ser His Leu Gly Thr Lys Glu Leu Gly Gly Val Thr Leu Gly Ser  
 115 120 125  
 Met Thr Ala Asn Ile Thr Gly Leu Ala Ala Ile Gln Gly Leu Cys Thr  
 130 135 140  
 Cys Leu Asp Thr Leu Cys Ala Gln Ala Tyr Gly Ala Lys Asn Tyr His  
 145 150 155 160  
 Leu Val Gly Val Leu Val Gln Arg Cys Ala Val Ile Thr Ile Leu Ala  
 165 170 175  
 Phe Leu Pro Met Met Tyr Val Trp Phe Val Trp Ser Glu Lys Ile Leu  
 180 185 190  
 Ala Leu Met Ile Pro Glu Arg Glu Leu Cys Ala Leu Ala Asn Tyr  
 195 200 205  
 Leu Arg Val Thr Ala Phe Gly Val Pro Gly Phe Ile Leu Phe Glu Cys  
 210 215 220  
 Gly Lys Arg Phe Leu Gln Cys Gln Gly Ile Phe His Ala Ser Thr Ile  
 225 230 235 240  
 Val Leu Phe Val Cys Ala Pro Leu Asn Ala Leu Met Asn Tyr Leu Leu  
 245 250 255  
 Val Trp Asn Asp Lys Ile Gly Ile Gly Tyr Leu Gly Ala Pro Leu Ser  
 260 265 270  
 Val Val Ile Asn Tyr Trp Leu Met Thr Leu Gly Leu Leu Ile Tyr Ala  
 275 280 285  
 Met Thr Thr Lys His Lys Glu Arg Pro Leu Lys Cys Trp Asn Gly Ile  
 290 295 300

Ile Pro Lys Glu Gln Ala Phe Lys Asn Trp Arg Lys Met Ile Asn Leu  
 305 310 315 320  
 Ala Ile Pro Gly Val Val Met Val Glu Ala Glu Phe Leu Gly Phe Glu  
 325 330 335  
 Val Leu Thr Ile Phe Ala Ser His Leu Gly Thr Asp Ala Leu Gly Ala  
 340 345 350  
 Gln Ser Ile Val Ala Thr Ile Ala Ser Leu Ala Tyr Gln Val Pro Phe  
 355 360 365  
 Ser Ile Ser Val Ser Thr Ser Thr Arg Val Ala Asn Phe Ile Gly Ala  
 370 375 380  
 Ser Leu Tyr Asp Ser Cys Met Ile Thr Cys Arg Val Ser Leu Leu Leu  
 385 390 395 400  
 Ser Phe Val Cys Ser Ser Met Asn Met Phe Val Ile Cys Arg Tyr Lys  
 405 410 415  
 Glu Gln Ile Ala Ser Leu Phe Ser Thr Glu Ser Ala Val Val Lys Met  
 420 425 430  
 Val Val Asp Thr Leu Pro Leu Leu Ala Phe Met Gln Leu Phe Asp Ala  
 435 440 445  
 Phe Asn Ala Ser Thr Ala Gly Cys Leu Arg Gly Gln Gly Arg Gln Lys  
 450 455 460  
 Ile Gly Gly Tyr Ile Asn Leu Val Ala Phe Tyr Cys Leu Cys Val Pro  
 465 470 475 480  
 Met Ala Tyr Val Leu Ala Phe Leu Tyr His Ile Gly Val Gly Leu Trp  
 485 490 495  
 Leu Gly Thr Thr Ser Ala Leu Val Met Met Ser Val Cys Gln Gly Tyr  
 500 505 510  
 Ala Val Pro His Gln Asp Arg Arg Arg Ile Leu Gly Ala Ala Arg Lys  
 515 520 525  
 Arg Asn Ala Glu Thr His Thr Ser  
 530 535

&lt;210&gt; 17

&lt;211&gt; 456

&lt;212&gt; PRT

&lt;213&gt; Arabidopsis thaliana

&lt;400&gt; 17

Met His Arg Tyr Lys Glu Glu Ala Ser Ser Leu Ile Lys Leu Ala Thr  
 1 5 10 15  
 Pro Val Leu Ile Ala Ser Val Ala Gln Thr Gly Met Gly Phe Val Asp  
 20 25 30  
 Thr Val Met Ala Gly Gly Val Thr Gln Thr Asp Met Ala Ala Val Ser  
 35 40 45  
 Val Ala Ser Ser Ile Trp Leu Pro Ser Ile Leu Phe Gly Ile Gly Leu  
 50 55 60  
 Leu Met Ala Leu Val Pro Val Val Ala Gln Leu Asn Gly Ser Ala Arg  
 65 70 75 80  
 Arg Glu Lys Ile Pro Phe Glu Ile Gln Gln Gly Val Val Leu Ala Leu  
 85 90 95  
 Leu Ile Ser Ile Pro Ile Ile Gly Val Leu Leu Gln Thr Gln Phe Ile  
 100 105 110  
 Leu Gln Leu Met Asp Val Glu Ala Val Met Ala Asp Lys Thr Val Gly  
 115 120 125  
 Tyr Ile His Ala Val Ile Phe Ala Val Pro Ala Phe Leu Leu Phe Gln  
 130 135 140  
 Thr Leu Arg Ser Phe Thr Asp Gly Met Ser Leu Thr Lys Pro Ala Met  
 145 150 155 160

24

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Val Ile Gly Phe Ile Gly Leu Leu Leu Asn Ile Pro Leu Asn Trp Ile
      165      170      175
Phe Val Tyr Gly Lys Phe Gly Ala Pro Glu Leu Gly Gly Val Gly Cys
      180      185      190
Gly Val Ala Thr Thr Ile Val Tyr Trp Val Met Phe Ala Leu Leu Leu
      195      200      205
Ala Tyr Val Met Thr Ser Ser Arg Leu Lys Ser Ile Asn Val Phe Gly
      210      215      220
Glu Tyr His Lys Pro Gln Trp Lys Ala Gln Val Arg Leu Phe Lys Leu
      225      230      235      240
Gly Phe Pro Val Ala Ala Ala Leu Phe Phe Glu Val Thr Leu Phe Ala
      245      250      255
Val Val Ala Leu Leu Val Ser Pro Leu Gly Pro Ile Ile Val Ala Ala
      260      265      270

His Gln Val Ala Ile Asn Phe Ser Ser Leu Val Phe Met Leu Pro Met
      275      280      285
Ser Val Gly Ala Ala Val Ser Ile Arg Val Gly His Arg Leu Gly Glu
      290      295      300
Glu Asn Val Asp Gly Ala Arg Val Ala Ser Arg Val Gly Ile Met Val
      305      310      315      320
Gly Leu Ala Leu Ala Thr Ile Thr Ala Ile Ile Thr Val Leu Ser Arg
      325      330      335
Glu Leu Ile Ala Glu Leu Tyr Thr Asn Asn Pro Glu Val Ile Thr Leu
      340      345      350
Ala Met Gln Leu Leu Leu Phe Ala Ala Val Tyr Gln Cys Thr Asp Ala
      355      360      365
Val Gln Val Ile Ala Ala Gly Ala Leu Arg Gly Tyr Lys Asp Met Arg
      370      375      380
Ala Ile Phe Asn Arg Thr Phe Ile Ala Tyr Trp Ile Leu Gly Leu Pro
      385      390      395      400
Thr Gly Tyr Ile Leu Gly Arg Thr Asp Trp Ile Val Glu Pro Met Gly
      405      410      415
Ala Gln Gly Phe Trp Leu Gly Phe Ile Ile Gly Leu Thr Ala Ala Ala
      420      425      430
Leu Met Leu Gly Val Arg Leu Arg Trp Met His Arg Gln Glu Pro Asp
      435      440      445
Val Gln Leu Asn Phe Ser Leu Gln
      450      455

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&lt;210&gt; 18

&lt;211&gt; 457

&lt;212&gt; PRT

&lt;213&gt; Arabidopsis thaliana

&lt;400&gt; 18

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Met Gln Lys Tyr Ile Ser Glu Ala Arg Leu Leu Leu Ala Leu Ala Ile
  1      5      10      15
Pro Val Ile Leu Ala Gln Ile Ala Gln Thr Ala Met Gly Phe Val Ser
      20      25      30
Thr Val Met Ala Gly Gly Tyr Ser Ala Thr Asp Met Ala Ala Val Ala
      35      40      45
Ile Gly Thr Ser Ile Trp Leu Pro Ala Ile Leu Phe Gly His Gly Leu
      50      55      60
Leu Leu Ala Leu Thr Pro Val Ile Ala Gln Leu Asn Gly Ser Gly Arg
      65      70      75      80
Arg Glu Arg Ile Ala His Gln Val Arg Gln Gly Phe Trp Leu Ala Gly
      85      90      95

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25

Phe Val Ser Val Leu Ile Met Leu Val Leu Trp Asn Ala Gly Tyr Ile  
                   100                  105                  110  
 Ile Arg Ser Met Glu Asn Ile Asp Pro Ala Leu Ala Asp Lys Ala Val  
                   115                  120                  125  
 Gly Tyr Leu Arg Ala Leu Leu Trp Gly Ala Pro Gly Tyr Leu Phe Phe  
                   130                  135                  140  
 Gln Val Ala Arg Asn Gln Cys Glu Gly Leu Ala Lys Thr Lys Pro Gly  
                   145                  150                  155                  160  
 Met Val Met Gly Phe Ile Gly Leu Leu Val Asn Ile Pro Val Asn Tyr  
                   165                  170                  175  
 Ile Phe Ile Tyr Gly His Phe Gly Met Pro Glu Leu Gly Gly Val Gly  
                   180                  185                  190  
 Cys Gly Val Ala Thr Ala Ala Val Tyr Trp Val Met Phe Leu Ala Met  
                   195                  200                  205  
  
 Val Ser Tyr Ile Lys Arg Ala Arg Ser Met Arg Asp Ile Arg Asn Glu  
                   210                  215                  220  
 Lys Gly Thr Ala Lys Pro Asp Pro Ala Val Met Lys Arg Leu Ile Gln  
                   225                  230                  235                  240  
 Leu Gly Leu Pro Ile Ala Leu Ala Leu Phe Phe Glu Val Thr Leu Phe  
                   245                  250                  255  
 Ala Val Val Ala Leu Leu Val Ser Pro Leu Gly Ile Val Asp Val Ala  
                   260                  265                  270  
 Gly His Gln Ile Ala Leu Asn Phe Ser Ser Leu Met Phe Val Leu Pro  
                   275                  280                  285  
 Met Ser Leu Ala Ala Ala Val Thr Ile Arg Val Gly Tyr Arg Leu Gly  
                   290                  295                  300  
 Gln Gly Ser Thr Leu Asp Ala Gln Thr Ala Ala Arg Thr Gly Leu Met  
                   305                  310                  315                  320  
 Val Gly Val Cys Met Ala Thr Leu Thr Ala Ile Phe Thr Val Ser Leu  
                   325                  330                  335  
 Arg Glu Gln Ile Ala Leu Leu Tyr Asn Asp Asn Pro Glu Val Val Thr  
                   340                  345                  350  
 Leu Ala Ala His Leu Met Leu Leu Ala Ala Val Tyr Gln Ile Ser Asp  
                   355                  360                  365  
 Ser Ile Gln Val Ile Gly Ser Gly Ile Leu Arg Gly Tyr Lys Asp Thr  
                   370                  375                  380  
 Arg Ser Ile Phe Tyr Ile Thr Phe Thr Ala Tyr Trp Val Leu Gly Leu  
                   385                  390                  395                  400  
 Pro Ser Gly Tyr Ile Leu Ala Leu Thr Asp Leu Val Val Glu Pro Met  
                   405                  410                  415  
 Gly Pro Ala Gly Phe Trp Ile Gly Phe Ile Ile Gly Leu Thr Ser Ala  
                   420                  425                  430  
 Ala Ile Met Met Met Leu Arg Met Arg Phe Leu Gln Arg Leu Pro Ser  
                   435                  440                  445  
 Ala Ile Ile Leu Gln Arg Ala Ser Arg  
                   450                  455

&lt;210&gt; 19

&lt;211&gt; 459

&lt;212&gt; PRT

&lt;213&gt; Arabidopsis thaliana

&lt;400&gt; 19

Met Pro Pro Gly Val Ala Val Cys Phe Ser Ser Leu Phe Ile Arg Leu  
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 Val Cys Met Ala Phe Leu Thr Ser Ser Asp Lys Ala Leu Trp His Leu  
                   20                  25                  30

Ala Leu Pro Met Ile Phe Ser Asn Ile Thr Val Pro Leu Leu Gly Leu  
 35 40 45  
 Val Asp Thr Ala Val Ile Gly His Leu Asp Ser Pro Val Tyr Leu Gly  
 50 55 60  
 Gly Val Ala Val Gly Ala Thr Ser Phe Leu Phe Met Leu Leu  
 65 70 75 80  
 Leu Phe Leu Arg Met Ser Thr Thr Gly Leu Thr Ala Gln Ala Tyr Gly  
 85 90 95  
 Ala Lys Asn Pro Gln Ala Leu Ala Arg Thr Leu Val Gln Pro Leu Leu  
 100 105 110  
 Leu Ala Leu Gly Ala Gly Ala Leu Ile Ala Leu Leu Arg Thr Pro Ile  
 115 120 125  
 Ile Asp Leu Ala Leu His Ile Val Gly Gly Ser Glu Ala Val Leu Glu  
 130 135 140  
  
 Gln Ala Arg Arg Phe Leu Glu Ile Arg Trp Leu Ser Ala Pro Ala Ser  
 145 150 155 160  
 Leu Ala Asn Leu Val Leu Leu Gly Trp Leu Leu Gly Val Gln Tyr Ala  
 165 170 175  
 Arg Ala Pro Val Ile Leu Leu Val Val Gly Asn Ile Leu Asn Ile Val  
 180 185 190  
 Leu Asp Val Trp Leu Val Met Gly Leu His Met Asn Val Gln Gly Ala  
 195 200 205  
 Ala Leu Ala Thr Val Ile Ala Glu Tyr Ala Thr Leu Leu Ile Gly Leu  
 210 215 220  
 Leu Met Val Arg Lys Ile Leu Lys Leu Arg Gly Ile Ser Gly Glu Met  
 225 230 235 240  
 Leu Lys Thr Ala Trp Arg Gly Asn Phe Arg Arg Leu Leu Ala Leu Asn  
 245 250 255  
 Arg Asp Ile Met Leu Arg Ser Leu Leu Leu Gln Leu Cys Phe Gly Ala  
 260 265 270  
 Ile Thr Val Leu Gly Ala Arg Leu Gly Ser Asp Ile Ile Ala Val Asn  
 275 280 285  
 Ala Val Leu Met Thr Leu Leu Thr Phe Thr Ala Tyr Ala Leu Asp Gly  
 290 295 300  
 Phe Ala Tyr Ala Val Glu Ala His Ser Gly Gln Ala Tyr Gly Ala Arg  
 305 310 315 320  
 Asp Gly Ser Gln Leu Leu Asp Val Trp Arg Ala Ala Cys Arg Gln Ser  
 325 330 335  
 Gly Ile Val Ala Leu Leu Phe Ser Val Val Tyr Leu Leu Ala Gly Glu  
 340 345 350  
 His Ile Ile Ala Leu Leu Thr Ser Leu Thr Gln Ile Gln Gln Leu Ala  
 355 360 365  
 Asp Arg Tyr Leu Ile Trp Gln Val Ile Leu Pro Val Val Gly Val Trp  
 370 375 380  
 Cys Tyr Leu Leu Asp Gly Met Phe Ile Gly Ala Thr Arg Ala Thr Glu  
 385 390 395 400  
 Met Arg Asn Ser Met Ala Val Ala Ala Ala Gly Phe Ala Leu Thr Leu  
 405 410 415  
 Leu Thr Leu Pro Trp Leu Gly Asn His Ala Leu Trp Leu Ala Leu Thr  
 420 425 430  
 Val Phe Leu Ala Leu Arg Gly Leu Ser Leu Ala Ala Ile Trp Arg Arg  
 435 440 445  
 His Trp Arg Asn Gly Thr Trp Phe Ala Ala Thr  
 450 455

&lt;210&gt; 20

&lt;211&gt; 1868

&lt;212&gt; DNA

<213> *Arabidopsis thaliana*

&lt;220&gt;

&lt;221&gt; CDS

&lt;222&gt; (118)...(1695)

&lt;400&gt; 20

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aaataatccc ctctaaactc tcctagatac tcactcatca ctactcatct caagttcacg 60
tgactactta tataagcggt gactacataa agagacagtt acagaggaaa aagatct atg 120
                                                    Met
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acg gaa act ggt gat gat ctt gct acg gtg aag aag cca atc cca ttt 168
Thr Glu Thr Gly Asp Asp Leu Ala Thr Val Lys Lys Pro Ile Pro Phe
                    5                      10                      15

ctc gtt atc ttc aaa gat tta aga cat gta ttc agt agg gac aca act 216
Leu Val Ile Phe Lys Asp Leu Arg His Val Phe Ser Arg Asp Thr Thr
                    20                      25                      30

ggg cga gag att cta ggc atc gcg ttt cca gca gct ttg gct tta gct 264
Gly Arg Glu Ile Leu Gly Ile Ala Phe Pro Ala Ala Leu Ala Leu Ala
                    35                      40                      45

gct gat cca atc gct tct ctg att gat acc gct ttt gtc ggg cgt tta 312
Ala Asp Pro Ile Ala Ser Leu Ile Asp Thr Ala Phe Val Gly Arg Leu
                    50                      55                      60                      65

gga gcg gtt cag cta gcg gcg gtt gga gtt tcc att gcc ata ttc aat 360
Gly Ala Val Gln Leu Ala Ala Val Gly Val Ser Ile Ala Ile Phe Asn
                    70                      75                      80

caa gct tct aga att acg ata ttc cca ctt gtg agc ctc aca act tca 408
Gln Ala Ser Arg Ile Thr Ile Phe Pro Leu Val Ser Leu Thr Thr Ser
                    85                      90                      95

ttt gtg gca gag gaa gac acg atg gag aag atg aaa gaa gaa gca aac 456
Phe Val Ala Glu Glu Asp Thr Met Glu Lys Met Lys Glu Glu Ala Asn
                    100                      105                      110

aaa gcc aat ctt gtt cat gca gaa act ata ctt gtt caa gat tct ttg 504
Lys Ala Asn Leu Val His Ala Glu Thr Ile Leu Val Gln Asp Ser Leu
                    115                      120                      125

gaa aag ggc att tct tca cct aca agt aac gat acc aac cag cca cag 552
Glu Lys Gly Ile Ser Ser Pro Thr Ser Asn Asp Thr Asn Gln Pro Gln
                    130                      135                      140                      145

caa cct cca gct ccg gat aca aag tca aat agc gga aac aaa tcg aat 600
Gln Pro Pro Ala Pro Asp Thr Lys Ser Asn Ser Gly Asn Lys Ser Asn
                    150                      155                      160

aaa aag gag aag agg acc att aga aca gca tca aca gct atg atc ttg 648
Lys Lys Glu Lys Arg Thr Ile Arg Thr Ala Ser Thr Ala Met Ile Leu
                    165                      170                      175

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ggg tta atc ctt ggc ctt gtg caa gct att ttc ttg att ttc agt tca	696
Gly Leu Ile Leu Gly Leu Val Gln Ala Ile Phe Leu Ile Phe Ser Ser	
180 185 190	
aag ttg ctt cta ggc gtc atg gga gtg aaa cca aat tca cca atg tta	744
Lys Leu Leu Leu Gly Val Met Gly Val Lys Pro Asn Ser Pro Met Leu	
195 200 205	
tca cca gca cac aag tac ttg agc ata cga gct ttg ggg gct cct gca	792
Ser Pro Ala His Lys Tyr Leu Ser Ile Arg Ala Leu Gly Ala Pro Ala	
210 215 220 225	
ttg ctt cta tct ctt gct atg caa ggc atc ttt cgt gga ttc aag gac	840
Leu Leu Leu Ser Leu Ala Met Gln Gly Ile Phe Arg Gly Phe Lys Asp	
230 235 240	
acc aaa act cct ctc ttt gcc act gtc gta gca gat gtt atc aac ata	888
Thr Lys Thr Pro Leu Phe Ala Thr Val Val Ala Asp Val Ile Asn Ile	
245 250 255	
gtt ctc gac ccc atc ttc att ttt gtg ctt cgt cta ggg atc atc ggt	936
Val Leu Asp Pro Ile Phe Ile Phe Val Leu Arg Leu Gly Ile Ile Gly	
260 265 270	
gca gcc att gcc cat gtc att tct cag tac ttc atg act cta ata ttg	984
Ala Ala Ile Ala His Val Ile Ser Gln Tyr Phe Met Thr Leu Ile Leu	
275 280 285	
ttc gtc ttc ctc gca aag aaa gtt aat ttg att cca cca aac ttc ggg	1032
Phe Val Phe Leu Ala Lys Lys Val Asn Leu Ile Pro Pro Asn Phe Gly	
290 295 300 305	
gat ttg cag ttt gga agg ttc ctt aaa aat ggg cta cta ttg ctg gcg	1080
Asp Leu Gln Phe Gly Arg Phe Leu Lys Asn Gly Leu Leu Leu Leu Ala	
310 315 320	
agg acc ata gca gtg acg ttt tgt cag acc tta gca gca gca atg gcg	1128
Arg Thr Ile Ala Val Thr Phe Cys Gln Thr Leu Ala Ala Ala Met Ala	
325 330 335	
gcg cgg ctg ggt aca aca cca atg gct gct ttt cag att tgt tta caa	1176
Ala Arg Leu Gly Thr Thr Pro Met Ala Ala Phe Gln Ile Cys Leu Gln	
340 345 350	
gta tgg tta act tct tct ctt ctc aat gat ggt ctt gcc gtt gct ggt	1224
Val Trp Leu Thr Ser Ser Leu Leu Asn Asp Gly Leu Ala Val Ala Gly	
355 360 365	
cag gcg att ctg gct tgt tcg ttt gct gag aag gac tat aac aaa gtg	1272
Gln Ala Ile Leu Ala Cys Ser Phe Ala Glu Lys Asp Tyr Asn Lys Val	
370 375 380 385	
act gct gtt gca tcc cgt gtt cta cag atg ggt ttt gtg tta gga ctt	1320
Thr Ala Val Ala Ser Arg Val Leu Gln Met Gly Phe Val Leu Gly Leu	
390 395 400	
gga ctg tcc gtt ttt gtt gga cta ggt ctc tac ttt ggt gcc gga gtt	1368
Gly Leu Ser Val Phe Val Gly Leu Gly Leu Tyr Phe Gly Ala Gly Val	
405 410 415	

ttc tcc aag gac cct gct gtt att cac ctc atg gcc atc gga ata ccg	1416
Phe Ser Lys Asp Pro Ala Val Ile His Leu Met Ala Ile Gly Ile Pro	
420 425 430	
ttt ata gca gca acg cag cca ata aac tct ctc gcc ttt gta ttg gat	1464
Phe Ile Ala Ala Thr Gln Pro Ile Asn Ser Leu Ala Phe Val Leu Asp	
435 440 445	
gga gtc aat ttt gga gca tct gat ttt gct tac act gca tac tcc atg	1512
Gly Val Asn Phe Gly Ala Ser Asp Phe Ala Tyr Thr Ala Tyr Ser Met	
450 455 460 465	
gtg gga gtg gcg gcc ata agc att gca gca gta ata tat atg gca aag	1560
Val Gly Val Ala Ala Ile Ser Ile Ala Ala Val Ile Tyr Met Ala Lys	
470 475 480	
acc aat ggt ttc ata gga ata tgg ata gct ctt aca atc tat atg gct	1608
Thr Asn Gly Phe Ile Gly Ile Trp Ile Ala Leu Thr Ile Tyr Met Ala	
485 490 495	
ctc cgg gct att act gga att gcc agg atg gcg aca gga act gga ccg	1656
Leu Arg Ala Ile Thr Gly Ile Ala Arg Met Ala Thr Gly Thr Gly Pro	
500 505 510	
tgg agg ttc ttg cgt gga cga tca tcc tct tca tct tcc taggaattag	1705
Trp Arg Phe Leu Arg Gly Arg Ser Ser Ser Ser Ser Ser	
515 520 525	
tttatttata acgagttgca tctcttcttc cttcttcggt tttgtttatg gttcttgtgt	1765
ttgtttttca acatcttgtt cgagagaccg ttatcatatt atcagtttca cataaataat	1825
gcatattttt aagtcattaa aataaaaaaaaa aaaaaaaaaa aaa	1868